

1 TITLE OF THE INVENTION

2 [0001] Cap Feeding Apparatus for a Fastener Gun

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9 CROSS REFERENCE TO RELATED APPLICATIONS

10 [0010] This application is a non-provisional application claiming priority of pending U.S.
11 provisional application 60/401,106 (filed August 5, 2002) entitled "Tool and Method for
12 Fastening Hold-Down Cap Washers," fully incorporated herein by reference. Additionally,
13 this application is a non-provisional application corresponding to and claiming priority of
14 pending U.S. provisional application 60/471,881 (filed May 20, 2003) entitled "Tool and
15 Method for Fastening Hold-Down Cap Washers," fully incorporated herein by reference.

16 STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
17 DEVELOPMENT

18 [0011] Not applicable.

19 REFERENCE TO COMPACT DISC(S)

20 [0012] Not applicable.

21 BACKGROUND OF THE INVENTION

22 [0015] 1. Field of the Invention: The present invention relates, in general, to building
23 construction tools, and in particular, to fastener driving tools for driving staples and nails and
24 the like through cap washers.

1 **[0020]** 2. Description of Related Art: It is often desired to use plastic cap washers to
2 hold down roofing paper and so-called building wrap tar paper. Well-known solutions for
3 this problem include providing plastic cap washers in bulk, each having a nail pre-inserted
4 through the plastic cap washer, and a hammer is then used by a construction worker to pound
5 the nail through roofing paper or tar paper wrapping and into a building. Application of such
6 plastic cap washers to hold down roofing paper or tar paper wrapping is manual, tedious, and
7 slow.

8 **[0025]** Automatic nail and staple guns, powered by compressed air or electricity, are
9 used, for example, to attach roofing material, such as tarpaper, to the roof of a house. A
10 generally fat cap is often used with each nail. A nail penetrates the cap and the tarpaper and
11 protrudes into the underlying roof structure, attaching the roof surface. One example of such
12 caps is disclosed in Bruins, U.S. Patent 5,407,313 (issued April 18, 1995).

13 **[0030]** Typically, an operator must manually place and hold a cap under the nose of a
14 nail gun and then trigger the gun to drive a nail through the cap into the roof structure. The
15 manual placement of caps presents a serious safety hazard to the operator because the
16 operator's hand is close to the nose of the gun. In addition, manual placement of caps is
17 time-consuming and inefficient. Another way the caps are made is with the nail already
18 pressed through the center of the cap. One example of such caps is disclosed in Schwingle,
19 U.S. Patent 6,010,291 (issued January 4, 2000). The installer of the cap must take each
20 cap/nail and hand bang them on to the work surface with a hammer. This is very time
21 consuming and difficult, not only hard on the back but hard on the fingers.

22 **[0035]** A cap feeding device may be employed to reduce the risk associated with manual
23 placement of caps and to improve the efficiency of the roofing operation. The cap feeding
24 device automatically places a cap under the nose of a fastener gun, and then the gun drives a
25 nail through the cap and into the underlying structure.

26 **[0040]** Prior art cap feeding devices generally include a cap magazine and a base having
27 an elongated channel. The base extends between the cap magazine and a position under the

1 nose of the fastener gun. It shall be understood that the term “fastener gun” is used herein to
2 indicate staple guns, nail guns, and similar construction tools for shooting a fastener, all of
3 which can be used to affix caps by a construction worker. Caps are fed into the channel of
4 the base from the cap magazine and pushed or pulled into position under the nose of the
5 fastener gun. When the gun is triggered, a nail penetrates and dislodges the cap under the
6 nose of the nail gun and protrudes into the underlying structure. The feeding of the caps
7 under the nose of the nail gun is coordinated with the ejection of the nails through the nose of
8 the nail gun, so that a cap is placed under the nose of the gun before the gun is triggered to
9 expel a fastener.

10 **[0045]** Such prior art cap feeding devices have a number of drawbacks. For example,
11 prior art cap feeding devices are generally heavy, putting additional stress on the operator’s
12 hand holding the fastener gun. Also, many prior art cap feeding devices can only be installed
13 close to the front end of a fastener gun, making the fastener gun not only heavy but also
14 unbalanced with most of the weight placed at the front end of the gun. This makes the nail or
15 staple gun difficult to handle and may put stress on the operator’s hand and wrist. In
16 addition, with so many components placed at the front end or side of the tool it is difficult to
17 see the position of the nose of the gun, making a precise placement of the nail difficult.

18 **[0050]** The conventional cap feeding devices are installed close to the front end of the
19 gun because designers need to place a conventional cap magazine close to the nose of the gun
20 to reduce the weight of the cap feeding device. The reason is that in many devices a cap is
21 pushed directly from the cap magazine to a position under the nose of the gun. Thus, if the
22 cap magazine is far from the nose of the gun, a long shuttle (with a correspondingly long
23 reciprocating stroke) is needed to push a cap from the magazine into position under the nose
24 of the fastener gun through the channel of the base. In addition, an actuator, such as an air
25 cylinder, with a long displacement stroke, is also needed to drive the shuttle. The
26 displacement stroke of the actuator should be about the same as the distance between the cap
27 magazine and the nose of the fastener gun. A long shuttle and actuator increase the weight

1 and size of the cap feeding device. With the cap feeding device placed near the nose of the
2 gun, the shuttle and actuator, and thus the cap feeding device, can be made lighter, smaller
3 and less expensive.

4 **[0055]** It is therefore desirable to have an automated construction tool and method of
5 using same that provides for easier installation of such plastic cap washers than has been
6 heretofore possible in the prior art. It is further desirable to have a lightweight cap feeding
7 apparatus for use with a fastener gun that allows a magazine of caps and the cap feeding
8 apparatus to be placed very close to the nose of the gun.

9 BRIEF SUMMARY OF THE INVENTION

10 **[0100]** The present invention is a cap feeding apparatus for use in combination with a
11 fastener gun, thereby creating a construction tool that is a combination of a fastener-driving
12 gun with a feeding magazine holding a clip of plastic cap washers to be affixed to a surface.

13 **[0110]** Three preferred embodiments of the invention are disclosed. The first two
14 embodiments are a cap feeding apparatus for use in combination with a staple gun, and,
15 specifically, a well-known bottom-load staple gun. The third embodiment is a cap feeding
16 apparatus for use in combination with a well-known nail gun that shoots successive nails
17 from a coil of nails.

18 **[0120]** A first preferred common feature of all three embodiments is that the cap feeding
19 apparatus receives caps in succession from a magazine of caps and then flips each cap about
20 an axis transverse to the feed direction, preferably about ninety degrees of flip, as the cap is
21 placed under the nose of the fastener gun. A shuttle reciprocates from a cap-receiving
22 position, in which the shuttle is substantially aligned with the cap magazine's leading cap, to
23 a cap-ejecting position in which the shuttle is not aligned with the cap magazine's leading
24 cap.

25 **[0130]** The first embodiment uses compression springs to bias the cap shuttle into its cap-
26 ejecting position, and the shuttle is moved into its cap-receiving position, with simultaneous

1 compressing of the compression springs, as the shuttle's feet are pressed against the
2 workpiece. The second and third embodiments use an air cylinder to reciprocate the shuttle
3 from the cap-ejecting position to the cap receiving position and back.

4 **[0140]** A second preferred common feature of all three embodiments is that, when the
5 shuttle is in the cap-ejecting position, the rearward edge of the shuttle engages the leading
6 portion of the leading cap in the magazine, while the trailing portion of the leading cap in the
7 magazine is retained by a biasing spring. As the shuttle reciprocates from the cap-ejecting
8 position to the cap receiving position, the rearward edge of the shuttle slides over the face of
9 the leading cap in the magazine and between the biasing spring and the trailing portion of the
10 leading cap. As the shuttle continues its reciprocation into the cap-receiving position, and the
11 forward edge of the shuttle just passes the trailing portion of the leading cap, the leading cap
12 is pushed from the magazine to a position in the feeding chamber immediately below the
13 forward edge of the shuttle so that the shuttle, upon reversing the direction of reciprocation,
14 can pull the leading cap through and then out of the feeding chamber. This use of both edges
15 of the shuttle, with the rearward edge of the shuttle retaining the leading portion of the
16 leading cap when the shuttle is in the cap-ejecting position in combination with the in spring
17 retaining means engaging the trailing portion of the leading cap in the magazine, and with the
18 forward edge of the shuttle feeding the leading cap from the magazine and out of the feeding
19 chamber, allows the shuttle to have greatly reduced height above its leading edge, thereby
20 allowing the cap feeding apparatus to be much closer to the nose of the gun and permitting a
21 shorter shuttle stroke and lighter-weight cap feeding apparatus than heretofore possible.

22 **[0150]** This invention provides a compact, light-weight cap feeding devise that
23 overcomes the problems associated with conventional nail/staple guns and cap feeding
24 devices. This invention provides a way that one end of the container/magazine can be placed
25 right next to the nose of the fastener gun with the cap magazine being located directly under
26 the fastener gun's handle. This makes for a substantially perfectly-balanced tool, as well as
27 providing improved view of the cap during shooting of the fastener.

1 **[0160]** The first embodiment of the invention feeds the caps without use of an air
2 cylinder to reciprocate the shuttle, which feeds the caps naturally and automatically as the
3 fastener gun is brought toward and away from the workpiece surface in the natural nailing or
4 stapling motion of the construction worker. Because the movement of the shuttle of the first
5 embodiment is a natural byproduct of the nailing or stapling motion, no four-way valve is
6 needed to control an actuator cylinder, simply because there is no actuator cylinder with the
7 first embodiment. All embodiments of the invention have no need for a long base or channel
8 to feed the caps to the nose of the fastener gun.

9 **[0170]** It is an object of the present invention to provide for easier and more rapid
10 installation of cap washers using a fastener-driving gun than heretofore possible.

11 **BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING**

12 **[0200]** Figs. 1 through 10B show a first embodiment of the present invention. Figs. 11
13 through 16 show a second embodiment of the present invention, and Figs. 17 through 20
14 show a third embodiment of the present invention.

15 **[0220]** Fig. 1 is a perspective view of a first embodiment of the cap feeding apparatus of
16 the present invention in combination with a bottom-feeding staple gun, and in which the cap
17 shuttle is biased toward one end of its reciprocation stroke by compression springs.

18 **[0230]** Fig. 2 is a perspective view of the first embodiment of the cap feeding apparatus
19 of the present invention with the staple gun removed and with some parts removed and with
20 some hidden portions shown for explanation.

21 **[0240]** Fig. 3 is an exploded perspective view of Fig. 2, showing how various parts are
22 assembled together.

23 **[0250]** Fig. 4 is an exploded perspective view of the cap pusher means of the cap
24 magazine, and showing the magazine door through which caps are loaded into the magazine.

25 **[0260]** Figs. 5A through 10B are sectional views showing the reciprocation of the shuttle
26 and the feeding of caps by the first embodiment of the present invention. The views with an

1 “A” suffix are similar side sectional views taken substantially along the center line of the cap
2 magazine and show the feed path of the caps through the feeding chamber. The views with a
3 “B” suffix are similar transverse sectional views taken along the indicated view line in the
4 respective view with an “A” suffix.

5 **[0270]** Fig. 5A is a longitudinal sectional view of the cap feeding apparatus showing caps
6 loaded in the cap magazine and the shuttle in the cap-ejecting position with no cap yet fed.

7 **[0280]** Fig. 5B is a transverse sectional view of the cap feeding apparatus taken
8 substantially along the line 5B-5B shown in Fig. 5A.

9 **[0290]** Fig. 6A is a longitudinal sectional view similar to Fig. 5A, except with the shuttle
10 being moved into the cap-receiving position as the shuttle’s feet are pressed against the
11 workpiece surface, and with the leading cap having just been pushed from the cap magazine
12 so that it is now immediately below the forward edge of the shuttle. Fig. 6B is a transverse
13 sectional view of the cap feeding apparatus taken substantially along the line 6B-6B shown in
14 Fig. 6A.

15 **[0300]** Fig. 7A is a longitudinal sectional view similar to Fig. 6A, except with the shuttle
16 being moved downward from the cap-receiving position as the fastener gun is raised from the
17 workpiece surface. The leading cap is being forced along the feed path by the forward edge
18 of the shuttle and is beginning to engage the flipper arm.

19 **[0320]** Fig. 7B is a transverse sectional view of the cap feeding apparatus taken
20 substantially along the line 7B-7B shown in Fig. 7A.

21 **[0340]** Fig. 8A is a longitudinal sectional view similar to Fig. 7A, except with the shuttle
22 being moved further downward and showing the flipper arm now engaging the back of the
23 emerging leading cap.

24 **[0360]** Fig. 8B is a transverse sectional view of the cap feeding apparatus taken
25 substantially along the line 8B-8B shown in Fig. 8A.

26 **[0380]** Fig. 9A is a longitudinal sectional view similar to Fig. 8A, except with the shuttle
27 now in the cap-ejecting position and at the end of its stroke, showing the flipper arm pinching

1 the trailing portion of the leading cap to the cap feeding body and holding the leading cap in
2 position for receiving a fastener from the fastener gun. Fig. 9A is identical to Fig. 5A except
3 that a cap has been fed and is now held into position for receiving a fastener from the fastener
4 gun.

5 **[0400]** Fig. 9B is a transverse sectional view of the cap feeding apparatus taken
6 substantially along the line 9B-9B shown in Fig. 9A.

7 **[0420]** Fig. 10A is a longitudinal sectional view similar to Fig. 6A except that a cap has
8 been fed into position and a fastener is now being driven through the cap as the fastener gun
9 is pressed against the workpiece surface, causing the legs of the shuttle to again move the
10 shuttle into the cap-receiving position for the next cycle.

11 **[0440]** Fig. 10B is a transverse sectional view of the cap feeding apparatus taken
12 substantially along the line 10B-10B shown in Fig. 10A.

13 **[0460]** Fig. 11 is an exploded perspective view of a second embodiment of the cap
14 feeding apparatus of the present invention in combination with a bottom-feeding staple gun,
15 and in which the cap shuttle is reciprocated by an air cylinder actuator.

16 **[0480]** Fig. 12 is a close-up front side perspective view of the second embodiment,
17 showing details of the notch on the shuttle arm for receiving the pin of the air cylinder
18 actuator.

19 **[0500]** Fig. 13 is a close-up front side perspective view of the second embodiment,
20 showing the details of air cylinder actuator pin engaging the notch of the shuttle arm. The
21 cover/guide of the air cylinder actuator has been removed to show these details.

22 **[0520]** Fig. 14 is a perspective view of the second embodiment of the cap feeding
23 apparatus mounted to a bottom load staple gun.

24 **[0540]** Fig. 15 is a partial side view of the bottom-load staple gun, showing how the cap
25 feeding apparatus telescopes apart after the air cylinder actuator pin emerges from the notch
26 of the shuttle arm to permit loading of the staple gun. The air cylinder is hidden on the back
27 side of the staple gun in this view.

1 [0560] Fig. 16 is a partial side perspective view similar to Fig. 15 but from the other side
2 and with the staple gun upside down, as is customary for ease of loading staples into the gun.

3 [0580] Fig. 17 is an exploded perspective view of a third embodiment of the cap feeding
4 apparatus of the present invention in combination with a top-load pneumatic nail gun, and in
5 which the cap shuttle is reciprocated by an air cylinder actuator and the cap feeding apparatus
6 is integrated into the gun.

7 [0600] Fig. 18 is side perspective view of the third embodiment in which the cap feeding
8 apparatus does not telescope apart and the pneumatic air cylinder actuator does not separate
9 from the shuttle arm.

10 [0620] Fig. 19 is a perspective view of the other side of the third embodiment, showing
11 details of the air feed - air return air cylinder actuator that reciprocates the shuttle.

12 [0600] Fig. 20 is an enlarged rear perspective view of the shuttle of the third
13 embodiment, showing details of the shuttle arm.

14 DETAILED DESCRIPTION OF THE INVENTION

15 [1000] The drawing figures show three preferred embodiments of the present invention.
16 All embodiments have many similarities, and, after describing the first embodiment and its
17 use and operation in detail, only the differences of the second and third embodiments will be
18 discussed in detail, it being understood that similar structures in all embodiments perform
19 similar functions. For clarity, reference numerals for the three embodiments will have
20 respective prefixes of "1.", "2.", and "3." to denote the individual embodiments, and similar
21 suffixes for the reference numerals will be used to indicate similar structure between the three
22 embodiments.

23 [1005] Referring to Figs. 1-10B, the fastener gun 1.30 used with the first embodiment is a
24 well-known so-called "80-Series" staple/nail gun. One such staple/nail gun that is suitable
25 for use with the first embodiment of the present invention is a model number S80/16 LN-A1
26 staple gun made and sold by Basso Corp., NO.24 36th Rd., Taichung Ind. Park, Taichung,

1 Taiwan, R.O.C.

2 [1010] Well-known staple gun 1.30 has a main body portion 1.32 and a handle portion
3 1.34. The tool 1.30 is provided with a magazine 1.36 for staples/nails. When the cap feeding
4 apparatus 1.40 of the present invention (see, e.g., Fig. 2) is used in combination with staple
5 gun 1.30, an improved staple gun 1.30 results. The tool 1.30 is illustrated as being a
6 compressed air actuated tool, the rearward end of the handle portion 1.34 having a air plug
7 1.38 where an air hose, not shown, can be attached and removed. This hose would lead to a
8 well-known compressed air source, not shown.

9 [1020] The main body portion 1.32 of the tool houses a main cylinder (not shown)
10 containing a piston driver blade (not shown). The main cylinder is connected to air under
11 pressure by means of a main valve (not shown) to force the piston/driver blade downwardly
12 to drive a nail/staple into the work surface. The main valve is actuated by a trigger valve (not
13 shown). A trigger 1.42 operates the trigger valve. This valve actuation mechanism just
14 described within the main body portion 1.32 is well known in the art. The precise nature of
15 the tool 1.30 is not a limitation of the present invention. There are many other ways that
16 fastener driving tools can be actuated, such as internal combustion means, electrical means,
17 and the like.

18 [1030] This staple gun by itself is made up of what has previously been described
19 together with an outer magazine 1.36 and an inner magazine 1.44. To load this magazine
20 with staples, the user must first pick the tool up by the handle portion 1.34 and push the
21 magazine release latch 1.46. This will allow the tool 1.30 and the outer magazine 1.36 to
22 slide forward opening the bottom side (not shown) of the outer magazine 1.36. The user
23 must then turn the tool upside down so that staples can be loaded into the underside of the
24 outer magazine 1.36.

25 [1040] Such staple guns as this are known as bottom-load staple guns, well known in the
26 art. Now that staples are loaded into the staple gun 1.30, the user must now load the caps
27 1.50 into the cap magazine 1.52. It shall be understood that the term "caps", as used herein,

1 shall refer generally to cap washers, and preferably, caps 1.50 are plastic and are typically
2 about the size of a U.S. quarter dollar. To load the caps into the cap magazine 1.52, the user
3 must first stand the tool up so that the air fitting is pointing straight up into the air. The user
4 must then pull up on the follower 1.54 which is connected to pusher 1.56 (see Fig. 4) so that
5 pusher 1.56 travels all the way rearward, away from the nose of the staple gun and up into the
6 top magazine door 1.58. Once this step has been performed, the user must pull straight out
7 on the follower 1.54 so that the top door 1.58 opens. It opens by pivoting on two pins 1.60
8 shown in Fig. 4, thereby removing the pusher 1.56 and follower 1.54 out of the cap magazine
9 1.52. Now that these are out of the way the user can load the caps 1.50. The caps are
10 collated in one of a number of ways. One preferred way of collating the caps is on so-called
11 “weed eater” plastic line with a loop at the top. The line is pushed through the center hole of
12 each cap (typically, 100 total) and then the bottom of the line is melted to keep the caps from
13 falling off with a loop at the other end. To load the cap magazine 1.52 with a plurality of
14 stacked caps 1.50 the user must pick the caps up by the loop and slide them down into the
15 cap magazine 1.52. Once they are in all the way the user must place one finger on the top of
16 the last cap in the stack and pull on the loop so that the weed eater line comes up and out of
17 the center holes of the caps and is discarded (cap assembly not shown). Once the caps are in
18 the cap magazine 1.52 and the loop/wire has been removed the user must then close the
19 magazine door 1.58 and move follower 1.54 (and thereby also move pusher 1.56) back on top
20 of the newly-loaded caps. The caps will then be forced toward the nose front plate 1.64 by
21 the pulling force of the well-known constant force spring 1.66 which is attached to the
22 follower 1.54 with a roll pin 1.68 and the nose back plate 1.70 with a bolt, as best seen in the
23 exploded view of Fig. 4.

24 [1043] It will be understood that pusher means 1.56 is for pushing the plurality of stacked
25 caps 1.50 through cap magazine 1.52 nose front plate 1.64. It will also be understood that
26 nose front plate 1.64 and nose back plate 1.70, when assembled together, comprise a cap
27 feeding body 1.72 having a feeding chamber 1.74 formed therewithin, with feeding chamber

1 1.74 having a first end 1.76 in communication with the front or first end 1.78 of cap
2 magazine 1.52 (such that caps 1.50 enter feeding chamber 1.74 from cap magazine 1.52
3 through the first end 1.76 of feeding chamber 1.74) and with feeding chamber 1.74 having a
4 second end 1.80 adjacent the nose 1.82 of gun 1.30, and caps 1.50 exit the feeding chamber
5 1.74 through second end 1.80 of feeding chamber 1.74.

6 [1045] As can be seen in Fig. 1, a cap 1.50 is shown already in place to be attached to the
7 work surface, once the tool 1.30 is pushed down against the work surface and a staple/nail is
8 shot from the nose of the staple/nail gun, through the already-fed cap, and into the work
9 surface. To attach the cap to the work surface, the user must first hook the tool 1.30 to a
10 source of compressed air and then press the tool down toward the work surface by holding
11 the handle portion 1.34 and pushing down. As the user pushes down, compression springs
12 1.62 will be compressed up into the nose front plate 1.64 along with shuttle 1.84, which,
13 through its legs 1.86, 1.88, and feet 1.90, 1.92, is connected to the rods 1.94, 1.96, and will
14 travel upward into the nose front plate 1.64 also. This allows for the cap 1.50 and nose 1.82
15 of the staple gun 1.30 to come down to the work surface. The user is then able to pull the
16 trigger 1.42 and attach the cap 1.50 to the work surface. This pushing down also allows for
17 the next cap 1.50' in sequence (the "follower cap" to the "leading cap" previously fed) in the
18 cap magazine 1.52 to be fed down and flipped in a manner hereinafter described.

19 [1050] As seen best in Fig. 5A, the plurality of stacked caps 1.50 inside the cap magazine
20 1.52 are retained within the cap magazine by retaining means 1.98 such as spring arm 1.100
21 and also by the rearward edge 1.102 of shuttle 1.84. It will be seen that retaining means 1.98
22 is in opposition to pusher means 1.56 for opposing emergence of the magazine's leading cap
23 1.50 therefrom.

24 [1050] Fig. 2 shows some portions of nose front plate 1.64 removed to show the
25 compression springs 1.62 that bias the shuttle into its cap-ejecting (or downward) position,
26 thereby forcing the currently-fed leading cap 1.50 down and out. Fig. 2 also shows the
27 mounting holes 1.104 in the cap magazine 1.52 and the mounting holes 1.106 in the top

1 bracket **1.108**. These mounting holes **1.106**, **1.104** are used to mount the staple gun **1.30** to
2 the cap magazine **1.52** and thereby to cap feeding apparatus **1.40**. Figs. 2 through 4 show the
3 various parts of the cap feeding apparatus **1.40**.

4 **[1060]** The shuttle **1.84** has two angled arms **1.110**, **1.112** that can engage the outside
5 edges of the cap **1.50** when the shuttle is in the cap-receiving (upward) position so as to align
6 the already-fed cap substantially perfectly under the nose **1.82** of the staple/nail gun **1.30**.
7 This happens as the shuttle **1.84** is traveling up into the cap feeding body **1.72**, when the
8 rearward edge **1.102** of shuttle **1.84** is within shuttle track portion **1.114**, as best seen in Fig.
9 10A. . A cap **1.50** has already been flipped out under the nose **1.82** of the tool **1.30** and the
10 tool **1.30** is being pressed downward to apply that cap **1.50**. As the tool **1.30** is pressed
11 down, the rearward edge **1.102** of shuttle **1.84** comes up into its track portion **1.114**, and, as it
12 does this, angled arms **1.110**, **1.112** come up along the side edges of the cap **1.50** and align
13 the cap under the nose **1.84**. It should be noted that shuttle **1.84** also releases a safety (not
14 shown, but well-known to those skilled in the art) for tool **1.30** when fully upward as shown
15 in Fig. 10A, thereby preventing firing of the fastener gun unless the nose of the gun is
16 adjacent the workpiece surface **S**.

17 **[1070]** Figs. 3 and 4 are exploded views from the left side of the feeding system for the
18 plastic caps. The staple gun is not included in these views. Some parts that have not been
19 pre are as follows: rod bolts and washers **1.116**, **1.118**; bottom rod bolts **1.120**, flipper arm
20 **1.122**, flipper arm spring **1.124**, and flipper arm roll pin **1.125**. As best seen in Figs. 5A
21 through 10A, flipper arm **1.122** is mounted to cap feeding body **1.72** for pivoting about the
22 axis of roll pin **1.125**, and the distal end **1.126** of flipper arm **1.122** is biased upwardly by
23 flipper arm spring **1.124** so as to engage fed caps as they emerge, as hereinafter described.

24 **[1080]** Fig. 4 is an exploded view of the cap pusher means at the back part of the cap
25 magazine **1.52** where the magazine door **1.58** can be opened and the pusher assembly moved
26 out of the way to allow the plurality of stacked caps to be inserted into the cap magazine
27 **1.52**. The magazine loading door **1.58** pivots about a pair of hinge pins **1.60**. A bolt **1.128**

1 secures follower **1.54** to pusher **1.56**. Follower spring **1.66** is mounted about spring drum
2 **1.130** which, in turn, is mounted for rotation about roll pin **1.68**, which retains spring drum
3 **1.130** within follower **1.54**. A bolt **1.132** secures the end of follower spring **1.66** to cap
4 magazine **1.52** as best seen in Fig. 1.

5 **[1090]** Fig. 5A is a longitudinal sectional view of the cap feeding apparatus in the region
6 of the nose **1.82** of fastener gun **1.30**. It is showing a plurality of stacked caps loaded in the
7 cap magazine **1.52** and the shuttle **1.84** in the cap-receiving (upward) position ready to be
8 pushed down so that a cap can be fed out and applied to the work surface. This is the first
9 position that the tool will always be in once the caps have been loaded. As can be seen from
10 this drawing, the caps **1.50** in the cap magazine **1.52** are held back from entering the shuttle
11 track area **1.114** of the feeding chamber **1.74**. It will be noted that the caps **1.50** are held
12 back by two things, one being the spring arm **1.100** engaging the trailing (top) portion **1.134**
13 of the leading cap **1.50**, and the other being the rearward edge **1.102** of the shuttle retaining
14 the leading (bottom) portion **1.136** of leading cap **1.50**. This is very important because if the
15 caps **1.50** were allowed to enter this track area **1.114** of the feeding chamber **1.74** before the
16 shuttle was in the cap-receiving position (i.e., upward), a cap **1.50** would become jammed up
17 into the bottom of the staple gun magazine (not shown). It should also be noted that the
18 pusher **1.56** is pushing the caps down the cap magazine toward the nose of the fastener gun..

19 **[1100]** Fig. 6A is a cross section of the same area as Fig. 5A but is showing that the
20 shuttle has been pushed upward into the cap receiving position. It should be noted that the
21 spring arm **1.100** has been pushed out of the track area **1.114** by the beveled rearward edge
22 **1.102** of the shuttle **1.84**, and the rearward edge of the shuttle has now become interposed
23 between the spring arm **1.100** and the leading cap **1.50**. The forward edge **1.138** of shuttle
24 **1.84** is preferably downwardly concave for best engagement with the leading cap **1.50** during
25 the downward stroke and, in the first embodiment of the present invention, the forward edge
26 **1.138** of the shuttle is generally downwardly "U" shaped. When the shuttle is in the cap-
27 receiving position (upward) as shown in Figs. 6A and 6B, the leading cap can and does

1 emerge from the cap magazine **1.52** in response to urging by the pusher **1.56**, and moves into
2 substantial coplanar relationship with the shuttle, forward of the shuttle's forward edge.

3 **[1110]** Fig. 7A is also a cross-section of the front area of the nose **1.82** of the tool. Figs.
4 7A and 7B show how the leading cap **1.50** has begun to travel downward and is starting to
5 push against and be engaged by the flipper arm **1.122**. The spring arm **1.100** is also shown
6 being allowed to begin to come back into the track area **1.114** to keep the next cap in
7 sequence (the "follower cap" **1.50'** to the leading cap **1.50** just fed) retained within the cap
8 magazine **1.52**.

9 **[1120]** Figs. 8A and 8B are the next time progression from Figs. 7A and 7B but show
10 that the spring arm **1.100** is holding the trailing portion of the follower cap **1.50'** in the cap
11 magazine **1.52** and preventing the follower cap **1.50'** from entering the feeding chamber. It
12 will be noted that the flipper arm **1.122** has been pushed out of the way and the flipper arm
13 spring **1.124** is applying pressure to the flipper arm **1.122** against the back of cap **1.50** to
14 cause cap **1.50** to be flipped about an axis transverse to the feed direction, preferably ninety
15 degrees of flip as shown by comparison of Figs. 8A-8B with Figs. 9A-9B.

16 **[1130]** Figs. 9A and 9B are the next time progression from Figs. 8A and 8B and now
17 show that the cap **1.50** has been flipped and is ready to be shot to the work surface by a
18 staple/nail gun. It also shows that the spring arm **1.100** is holding the trailing portion of the
19 new leading cap **1.50'** in the cap magazine, and the rearward edge **1.102** of the shuttle **1.84** is
20 holding the leading portion of the new leading cap **1.50'** in the cap magazine **1.52** from
21 coming out into the feeding chamber. This also shows that the flipper arm **1.122** holds the
22 previously-fed cap **1.50** in place until the tool **1.30** is pushed down and the cap **1.50** is shot to
23 the work surface.

24 **[1140]** Figs. 10A and 10B are the next time progression with the tool **1.30** having been
25 pushed down to staple/nail the previously-fed cap to the work surface, with the previously-
26 fed cap now being shot to the work surface. The cycle repeats as before.

27 **[2000]** Referring to drawing Figs. 11 through 16, an improved second embodiment of the

1 present invention, namely, a cap feeding system for a bottom-load staple gun, will now be
2 described in detail. Because there are many similarities with the first embodiment, only the
3 differences will be described in detail, it being understood that similar structural features
4 perform similar functions in the same way in both embodiments.

5 **[2010]** Another way to make this tool without compromising the weight and balance of it
6 is to add an air cylinder to operate the shuttle that feeds the caps down and flips them
7 sideways. By doing this the operator of the tool does not have to manually push down to
8 compress the springs that are attached to the shuttle which then pulls the cap down and flips
9 it sideways as described in the first embodiment. This makes for a less strenuous operation
10 of the tool. The air cylinder is mounted on the side of the body of the tool, it is a spring feed
11 and air returned air cylinder. What this means is that every time the air tool is fired air is
12 applied to the underside of the piston of the air cylinder. This causes the air cylinder shaft
13 **2.190** of the air cylinder **2.194** to retract up into the cylinder, as it retracts upward it pulls the
14 shuttle **2.84** up to allow another cap **2.50** to be fed down and out. Once the piston of the air
15 cylinder has reached the top of it's stroke a spring pushes the piston back down. So the long
16 and short of it is, air pushes the piston up and a spring pushes it back down. This could also
17 be done with an air cylinder that is air fed and air returned.

18 **[2020]** The main difference between the first embodiment and the second is what makes
19 the shuttle operate. In the first embodiment two springs are compressed allowing the shuttle
20 to go up and then they force it back down. In the second embodiment an air cylinder causes
21 the shuttle to reciprocate. Because Figs. 11 through 16 are of a tool that is a bottom-load
22 staple gun and because the air cylinder **2.194** needs to be attached to the housing of the air
23 tool **2.30**, the shuttle **2.84** and the shaft of the air cylinder **2.190** must separate when loading
24 staples into the air tool **2.30**. Please note that this is not the case if the tool is not a bottom-
25 load staple gun. Please see Figs. 17 through 20 to see how an air cylinder that is an air feed /
26 air return is mounted on a tool that is not a bottom-load tool. In this case the shuttle and the
27 air cylinder shaft can stay connected at all times. This will be discussed in full in the coming

1 paragraphs.

2 [2030] Fig. 11 is an exploded view of the staple gun and the plastic cap feeding system
3 that is integrated onto it. It shows all the parts and how they assemble together.

4 [2035] A suitable fastener gun **2.30** for use with the second embodiment is, like the first
5 embodiment, a well-known so-called “80-Series” staple/nail gun. As with the first
6 embodiment, one such staple/nail gun that is suitable for use with the second embodiment of
7 the present invention is a model number S80/16 LN-A1 staple gun made and sold by Basso
8 Corp., NO.24 36th Rd., Taichung Ind. Park, Taichung, Taiwan, R.O.C.

9 [2040] Fig. 12 is a front view of the cap feeding system for a bottom-load staple gun **2.30**
10 (see Fig. 14). The air cylinder **2.194** is not shown because it is mounted on the staple gun
11 **2.30** itself. It also shows a shuttle **2.84** and how it has an open slot or notch **2.187** to receive
12 the actuator drive pin **2.195** (see Fig. 13). This drawing also shows that the nose front plate
13 **2.64** has been changed and no longer has the two areas that house the compression springs
14 **1.62** as described in the first embodiment. The nose front plate **2.64** has also been changed
15 and had a shuttle arm slot **2.188** cut in it to allow an arm **2.150** of the shuttle **2.84** to extend
16 out through the nose front plate **2.64**. This allows the shuttle **2.84** to be moved up and down
17 by the air cylinder, thereby retrieving a succession of caps **2.50** to feed down and out.

18 [2050] Fig. 13 is a front view of the cap feeding system with a bottom-load staple gun
19 **2.30** mounted on it. The air cylinder cover/guide **2.192** (see Fig. 14) has been removed so as
20 to show how the actuator drive pin **2.195** aligns and fits right into notch **2.187** when the
21 staple gun outer magazine **2.36** has been closed.

22 [2060] Fig. 14 is a front side view of the complete assembly of the cap feeding system
23 with the bottom-load staple gun **2.30** mounted on it. It is showing the air cylinder
24 cover/guide **2.192** with a groove **2.193** cut into the side of it. It is also showing the actuator
25 drive pin **2.195** protruding out of the groove **2.193** which it uses as a guide. The reason this
26 cover/guide **2.192** is needed is so the actuator drive pin **2.195** will align back up with the
27 notch **2.187** in the shuttle **2.84** when you finish loading staples into the outer magazine **2.36**

1 and you close it.

2 **[2070]** Fig. 15 is a right side view of the staple gun being opened to load staples into the
3 outer magazine **2.36**. You can also see how the actuator drive pin **2.195** has separated from
4 the shuttle notch **2.187** (see Fig. 12) and how the air cylinder cover/guide **2.192** is holding the
5 air cylinder shaft **2.190** and the actuator drive pin **2.195** in place so that when the staple
6 magazine is closed the shuttle notch **2.187** and the actuator drive pin **2.195** will line back up
7 and receive each other. The reason it stays in place is because the actuator drive pin **2.195**
8 protrudes out through the groove **2.193** (see Fig. 14).

9 **[2080]** Fig. 16 is a side view of the complete assembly of the cap feeding system with the
10 bottom-load staple gun mounted on it. This drawing is showing the tool in the up side down
11 position. This is how the tool would be when you are loading staples into the outer magazine
12 **2.36**. It is also showing the arrow **AA** as being the outer magazine **2.36** and the arrow **BB** as
13 being the inner magazine **2.81**. This shows the direction that the two magazine parts would
14 go in when you open them to load staples.

15 **[3000]** Figs. 17 through 20 show a third embodiment of the present invention, namely, a
16 cap feeding system for a top-load pneumatic coil nail gun **3.30**, with differences from the
17 second embodiment now being described.

18 **[3010]** Fig. 17 is an exploded view of a coil nail gun and the plastic cap feeding system
19 that is integrated onto it.

20 **[3015]** A suitable top-load pneumatic coil nail gun **3.30** for use with the third
21 embodiment is a model number C21/50 LN-A1 coil nail gun made and sold by Basso Corp.,
22 NO.24 36th Rd., Taichung Ind. Park, Taichung, Taiwan, R.O.C.

23 **[3020]** Fig. 18 is a front side view of the cap feeding system mounted on a pneumatic coil
24 nail gun **3.30** that is not a bottom-load tool **2.30** (see Fig 14). It is a top-load tool. This also
25 shows how the shuttle **3.84** does not need to separate from the air cylinder shaft **3.190**. It
26 shows how a bolt **3.199** and nut keep these two items connected at all times. To load this
27 tool with nails you would push down on the door latch **3.197** which would pivot open on the

door hinge pin **3.196** this in turn would allow you to open the back magazine cover **3.198**.
Once this has been done you would install the coil nails into the magazine and feed them into
the nose and then close the nose door **3.185**.

[3030] Fig. 19 is a back side view of the cap feeding system mounted on a pneumatic coil
nail gun **3.30**. It is showing how a air-feed air-return **3.194** air cylinder is used and operates
by using the different air chambers of the coil nailer. When air is applied to the air plug **3.82**
of the tool, air enters the air cylinder feed line **3.00**. This applies air to the top of the air
cylinder **3.194** piston causing the air cylinder shaft **3.190** to be forced downward. This
ensures that a cap **3.50** is ready to be attached to the work surface. To attach a cap you must
push the area of the tool closest to the nose front plate **3.64** down. This will push the safety
3.85 up making contact with the trigger **3.42**. Once you have done this you can pull up on
the trigger **3.42** which will fire the nail gun. When you pull the trigger **3.42** this will release
the air that is in the air-feed cylinder line **3.00** and will apply air to the air cylinder return line
3.01 causing the shuttle **3.84** to retract and pick up another cap **3.50** and feed it down and out
once the tool is picked up from the work surface.

[3040] Fig. 20 is a drawing of the shuttle used in the cap feeding system that has the
pneumatic top-load coil nailer **3.30** mounted on it. The only difference between this shuttle
3.84 and the shuttle **2.84** is that shuttle **3.84** is bolted to the air cylinder shaft **3.190**, whereas
shuttle **2.84** is not because shuttle **2.84** is designed to separate from the air cylinder shaft
2.190 to enable the bottom-load staple gun **2.30** to be loaded with staples as described earlier.

[4000] Although the present invention has been described and illustrated with respect to
preferred embodiments and a preferred use therefor, it is not to be so limited since
modifications and changes can be made therein which are within the full intended scope of
the invention.